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GB 2270353 A GB 2089453 A US 5754099 A
US 5420792 A

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(54) Abstract Title
Method for automatically triggering a braking action of a vehicle

(57) In a method for automatically triggering a braking action of a vehicle, when the vehicle speed is less than a limit value (G4, Fig.1) e.g.between 2 and 18 km/h, the distance to an obstacle Hi1, Hi2 located in front of, or behind, the vehicle is recorded by sensors S and the speed of approach of the vehicle (vA) to the obstacle is determined. Automatic braking is triggered when the distance falls short of a limit value (G1), e.g.between 0.5 and 2 m, and when the speed of approach of the vehicle (vA) to the obstacle exceeds a limit value (G2), e.g.between 4 and 16 km/h, and continues until the vehicle speed assumes a limit value for crawling speed, e.g.between 3 and 5 km/h.

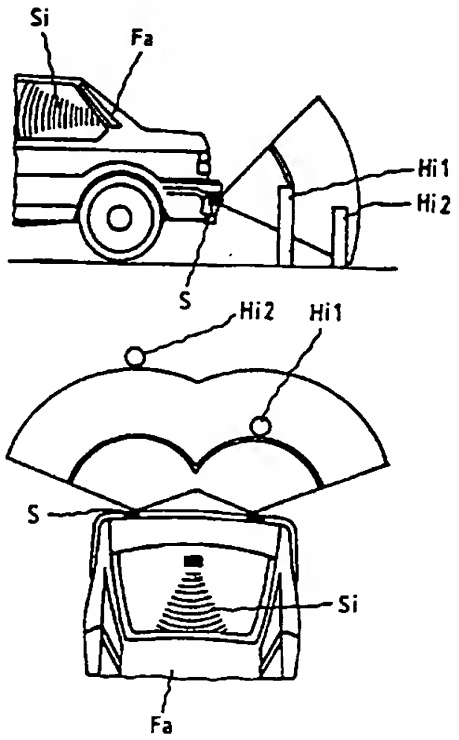

Fig. 2

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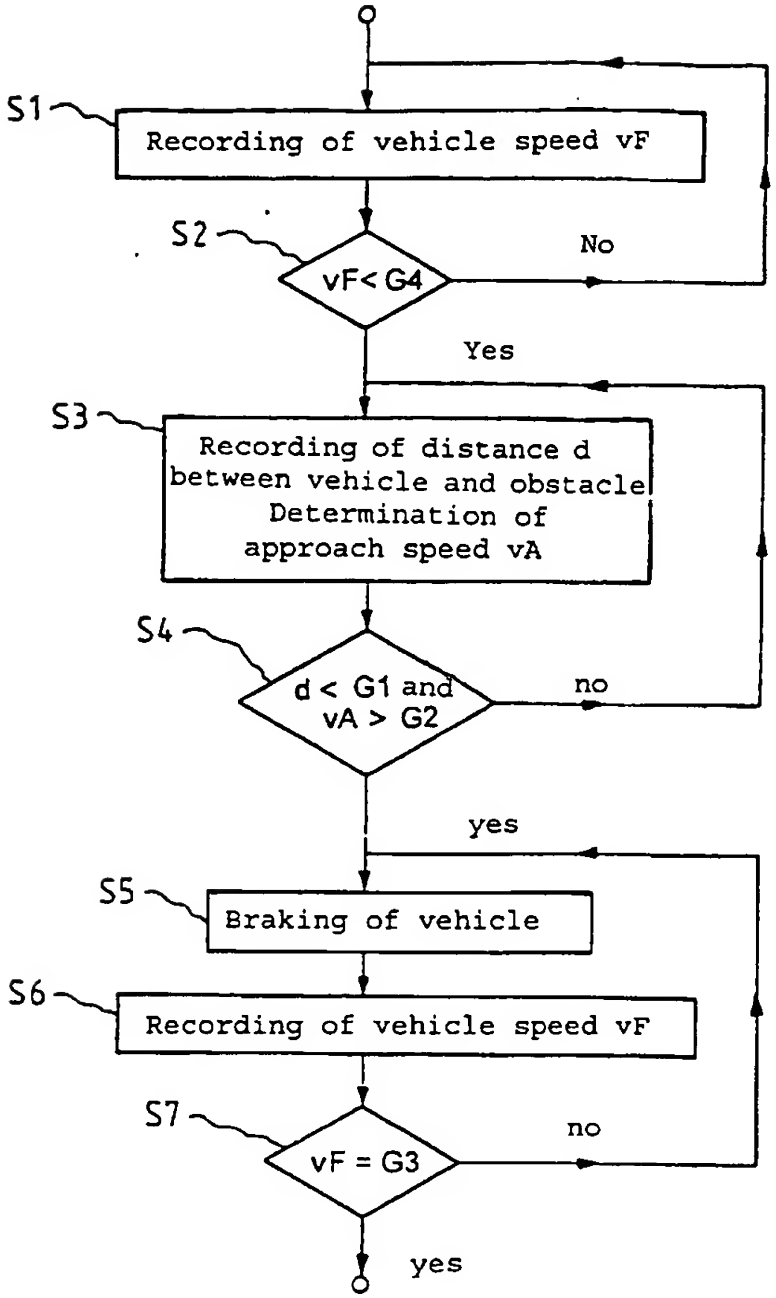
S1
Recording of vehicle speed vF
S2
vF< G4
No
Yes
S3
Recording of distance d between vehicle and obstacle Determination of approach speed vA
S4
d < G1 and vA > G2
no
yes
S5
Braking of vehicle
S6
Recording of vehicle speed vF
S7
vF = G3
no
yes

Fig. 1

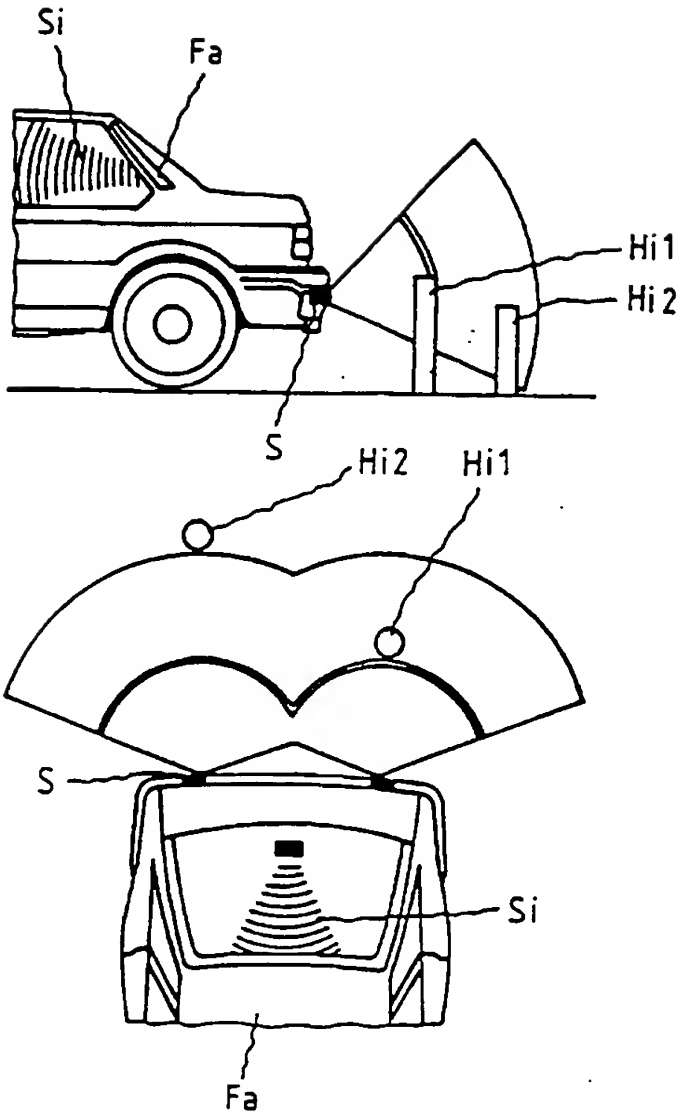

Fig. 2

Method for automatically triggering a braking action of a vehicle

The invention relates to a method for automatically triggering a braking action of a vehicle.

Methods are known, in which an automatic braking action is triggered when the speed of actuation of a brake pedal exceeds a trigger threshold value. During the automatic braking action, a brake pressure is generated, which is higher than the brake pressure corresponding to the position of the brake pedal.

In a method known from DE 197 49 296.7, the distance to a vehicle in front is recorded and the trigger threshold value for the automatic braking action is reduced when the distance to the vehicle in front falls short of a limit value, in order thereby to increase the safety of vehicles by carrying out as quickly as possible, in the case of short distances, emergency braking which, within what is physically possible, ensures high deceleration of the vehicle and thus assists in avoiding rear-end collisions.

Electronic parking aids for motor vehicles have also been known for some time, and in these the distance of the vehicle to an obstacle located in front of or behind the vehicle is recorded by sensors arranged in the front/rear region of the vehicle and a warning signal is emitted when this distance falls short of a predetermined threshold value.

A parking aid of this type may be gathered, for example, from the German periodical Elektronik No. 22 of 31.10.1986, page 48 ff.

The present invention seeks to provide a method for automatically triggering a braking action of a vehicle, by means of which repair damage caused by collisions during the parking operation is reduced substantially.

According to the present invention there is provided a method for automatically triggering a braking action of a vehicle, the distance to an obstacle located in front of and/or behind the vehicle being recorded by sensors and automatic braking triggering being carried out when the distance falls short of a limit value for the distance and when the speed of approach of the vehicle to the obstacle exceeds a predeterminable limit value for the approach speed. Recording the distance of a vehicle to an obstacle located in front of or behind the vehicle and triggering an

automatic braking action when the distance falls short of a predeterminable limit value for the distance and when the speed of approach of the vehicle to the obstacle simultaneously exceeds a predeterminable limit value for the approach speed has the advantage that the risk of a collision between the vehicle and the obstacle is not only recognized, but also avoided as a result of the triggering of the automatic braking action.

This advantageously avoids the situation where the bumpers have to be adapted to test regulations specific to particular regional administrations. Instead, predetermining and selecting the limit value for the distance and the limit value for the approach speed makes it possible to ensure that repair damage caused by collisions during the parking operation is substantially avoided. Since, in practice, active damage to the vehicle thereby becomes impossible, vehicles making use of the method according to the invention are also classified in a favourable insurance type class, so that, in this respect, too, advantages are afforded.

The subclaims relate to advantageous embodiments of the invention.

Thus, for example, the recording of the distance between vehicle and obstacle and the recording of the speed of approach of the vehicle to the obstacle may be carried out by means of ultrasonic sensors. Since virtually all parking aids use ultrasonic sensors for distance determination, additional sensors for determining the approach speed may thereby be dispensed with.

In another advantageous embodiment, there is provision for recording the distance and the approach speed by means of radar sensors.

In order to ensure that an automatic braking action is triggered only during a parking operation, there is provision for triggering the automatic braking action only when the vehicle speed does not exceed a predeterminable limit value for the vehicle speed.

The vehicle is preferably braked with a predeterminable braking deceleration which is set at an average value which, on the one hand, allows safe braking within the relevant speed range and, on the other hand, does not lead to loss of comfort due to braking which is too abrupt.

Furthermore, there is provision for braking the vehicle only until its speed assumes a predeterminable limit value for crawling speed. This limit value is

selected in such a way that it is possible for the vehicle to be parked without difficulty and, if the conventional bumper systems are used, without being damaged.

In an advantageous embodiment, the value of the limit value for the distance is between 0.5 and 2 m, preferably 1 m, and the value of the limit value for the approach speed may vary between 4 and 16 km/h and is usually 8 km/h. The value of the limit value for the vehicle speed is between 2 and 18 km/h, preferably 8 km/h, and the value of the limit value for crawling speed is advantageously between 3 and 5 km/h, preferably 4 km/h.

An embodiment of the method according to the invention is explained in more detail below with reference to the drawing in which:

Figure 1 shows diagrammatically a flow chart of an embodiment of a method according to the invention, and

Figure 2 shows, by way of example, the arrangement of sensors for recording the distance and the speed of approach to an obstacle in the rear region of a vehicle.

An embodiment of a method for automatically triggering a braking action of a vehicle is explained below with reference to the flow chart illustrated diagrammatically in Figure 1.

First, in a first step S1, the speed vF of a vehicle is determined in a way known per se, for example by wheel sensors of an ABS system.

In a step S2, a check is made as to whether this vehicle speed vF is lower than a predeterminable limit value for the vehicle speed G4. The limit value for the vehicle speed G4 moves between 2 and 18 km/h. A value of 8 km/h is preferably selected for this limit value G4. It is thereby established whether the vehicle is moving at a speed which is typical of a parking operation.

If the vehicle speed vF is lower than the limit value for the vehicle speed G4, that is to say lower than, for example, 8 km/h, the distance d between the vehicle and one or more obstacles Hi1, Hi2 and the speed of approach vA to the obstacle or obstacles Hi1, Hi2 are determined by means of sensors which are preferably arranged in the front and rear regions of the vehicle.

Figure 2 illustrates, by way of example, the arrangement of ultrasonic sensors S in the rear region of a vehicle Fa for determining the distance between the

vehicle Fa and obstacles Hi1, Hi2. Sensors S of this type are also arranged in the front region of the vehicle. It goes without saying that, if sensors of a parking aid are present, they can be used for determining the distance d.

In addition to ultrasonic sensors, for example radar sensors or other sensors suitable for distance determination may also be used.

The approach speed vA may be determined in a simple way in a computing unit (not illustrated) by recording and determining the reduction in the distance d per unit time. Additional speed sensors or the like may thereby be dispensed with, and, instead, the distance sensors S themselves are used in this way in order to determine the approach speed vA.

A check is now made in step S4, as to whether the distance d falls short of a predeterminable limit value for the distance G1, which limit value may vary, for example, between 0.5 and 2 m and is preferably 1 m, and whether the approach speed vA simultaneously exceeds a predetermined limit value for the approach speed G2, which limit value may advantageously vary between 4 and 16 km/h and is, for example, 8 km/h. If this is so, on the one hand, an acoustic and/or optical signal Si can be emitted by a signal generator arranged in the vehicle Fa, as is also the case, for example, in parking aids known from the prior art, and, on the other hand, in step S5, an automatic braking action of the vehicle Fa is initiated and the vehicle Fa is braked with a predeterminable average braking deceleration which is, for example, 0.5 g, until its speed vF assumes a limit value for crawling speed G3, which limit value may vary, for example between 3 and 5 km/h and is advantageously 4 km/h.

The recording of the vehicle speed vF and the comparison of the vehicle speed vF with the limit value for crawling speed G3 are carried out in steps S6 and S7.

An average braking deceleration of 0.5 g is certainly sufficient, for example in the case of a braking travel of 0.5 m, to reduce the speed of the vehicle vF from 8 km/h to 4 km/h. Since the braking action is initiated automatically, the bumpers of the vehicle Fa may consequently be designed in such a way that they merely have to absorb speeds of 4 km/h, without being damaged, or have reserves for higher impact speeds. It thereby becomes possible that vehicles need be equipped only with one type of bumper, even if test regulations specific to particular regional administrations prescribe the adaptation of the bumper systems to different collision speeds. In the

method described above, conformity to regulations specific to particular regional administrations is, as it were, "shifted to the electronic level" by predetermining the limit values and predetermining the average braking deceleration. This is possible with only a relatively low technical outlay and, in particular, may be carried out without difficulty even on existing vehicles which have a parking aid, since the method can be carried out by means of parking aids known per se.

Claims

1. A method for automatically triggering a braking action of a vehicle, the distance to an obstacle located in front of and/or behind the vehicle being recorded by sensors and automatic braking triggering being carried out when the distance falls short of a limit value for the distance and when the speed of approach of the vehicle to the obstacle exceeds a predeterminable limit value for the approach speed.

2. A method according to Claim 1, wherein the distance and the approach speed are determined by means of ultrasonic sensors.

3. A method according to Claim 1, wherein the distance and the approach speed are determined by means of radar sensors.

4. A method according to any one of Claims 1 to 3, wherein the automatic braking action is triggered only when the vehicle speed does not exceed a predeterminable lower limit value for the vehicle speed.

5. A method according to any one of the preceding claims, wherein the vehicle is braked until its speed assumes a predeterminable limit value for crawling speed.

6. A method according to any one of the preceding claims, wherein the vehicle is braked with a predeterminable braking deceleration.

7. A method according to any one of the preceding claims, wherein the limit value for the distance is between 0.5 and 2 m, the limit value for the approach speed (G2) is between 4 and 16 km/h, the limit value for the vehicle speed is between 2 and 18 km/h, and the limit value for crawling speed is between 3 and 5 km/h.

8. A method according to claim 7, wherein the limit value for the distance is 1 m.

9. A method according to claim 7 or 8, wherein the limit value for the approach speed is 8 km/h.

10. A method according to any one of claims 7, 8, or 9, wherein the limit value for the vehicle speed 8 km/h.

11. A method according to any one of the preceding claims, wherein the limit value for crawling speed is 4 km/h.

12. A method for automatically triggering a braking action of a vehicle, substantially as described herein with reference to and as illustrated in the accompanying drawings.

The Patent Office

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Application No: GB 9903758.2 **Examiner:** Peter Squire
Claims searched: 1-11 **Date of search:** 5 May 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2F FC

Int Cl (Ed.6): B60T 7/22

Other: Online:WPI,EPODOC,JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2270353 A	(Fuji Jukogyo) see e.g.Fig.4 & pages 12/13	1
X	GB 2089453 A	(Honda) see e.g.page 1 lines 114-127	1
X, P	US 5754099	(Nippondenso) see e.g.Figs.4 & 8	1
X	US 5420792	(Mazda) see e.g.Fig.5	1, 3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.